REMARKS/ARGUMENTS

In the Office Action mailed on June 24, 2009, the Examiner rejected Claims 1-8 of this application under 35 U.S.C. 102(b) as anticipated by Inoue (USPN 4,511,595).

Applicant appreciates the time and consideration provided by the Examiner in reviewing this application.

Applicant amended the pending claims 1-6 and 8 to clarify the subject matter of the invention, and cancelled claim 7. In making these revisions care has been taken that no new matter is introduced and the amended claims are fully supported by the specification as originally filed in the present application.

In particular, the following amendments have been made to the pending claims 1-6, and 8.

1) An additional limitation "for protecting special products printed on the sheet material against counterfeit" is inserted into the preamble of the independent method claim 1 and independent apparatus claim 8. This feature is disclosed in the specification of present invention, see page 1, paragraph 1; page 4, line 31- page 5, line 5, and page 6, lines 6-8, of the English translation of International Application PCT/RU2004/000264.

2) An additional limitation "laser radiation pulses" is also inserted into independent method claim 1. This feature is disclosed, for example, in dependent claims 2 and 7 as originally filed, and is already present in independent claim 8. In view of this amendment, said claim 7 is deleted; the term "electromagnetic" is replaced with the term "laser" in each of claims 2, 3, 4, 5 for consistency of terminology;

3) An additional limitation "within its thickness" (meaning "within the thickness of the sheet material") is inserted into the independent method claim 1 and the independent apparatus claim 8. This feature is disclosed in the specification of present invention, on page 3, lines 7-9. Moreover, the deposition of the metal in the recesses (channels) formed in the sheet material by the laser radiation is clearly shown in Fig.1D of the present application.

4) Claim 1 is reworded to clarify the subject matter of the method of the present application by using the term "exposing" recited in initial claim 1 and the term "deposit" recited

in initial claims 3, 5 and 6. Claim 8 is also reworded to clarify the subject matter of the claimed invention (apparatus) in conformity with the now amended claim 1.

5) Claims 3, 4 and 5 are made dependent on claim 1, because the feature of laser radiation pulses and the feature of deposition are now included into claim 1.

Applicant respectfully traverses the rejection at least for the following reasons:

Claim 1 and 8:

1. In the rejection of claim 1 of the present invention, the Examiner stated: "Inoue discloses ... the process of applying a solution ... and impregnating the sheet material with [the] solution (col.4, lines 55-58 and col.8, lines 28-36)".

In fact, the cited column 4 in lines 55-58 of the Inoue patent discloses as follows:

> "In operation, the delivery chamber 6 is furnished with a chemical-depositing solution, e.g. nickel or copper plating solution to deliver it to the surface of the workpiece 3 at a high velocity as previously indicated."

The cited column 8 in lines 28-36 of the Inoue patent in fact discloses as follows:

> "As is common, the solution further contains NaOH in an amount to adjust the pH value at 12.5[.] The solution has a temperature of 5°C and is introduced through the inlet 5 into the worktank 2 to flow rapidly in the region of the upper surface of the board 3 so that little deposition of the copper metal from the solution is caused thereon. The flowing solution 4 is drained out of the worktank through the outlet 9."

The above two cited fragments of the Inoue patent do not disclose any impregnating process, either explicitly or implicitly.

The first cited fragment discloses only that a nickel or copper plating *solution is delivered to the surface of the workpiece 3*.

The second cited fragment discloses only that the solution is introduced into the worktank 2 *to flow rapidly in the region of the upper surface of the board 3* and the flowing solution 4 is drained out of the worktank.

The delivery of the solution to the surface of the workpiece (as in the first cited fragment) or the flow of the solution in the region of the upper surface of the workpiece (as in the second cited fragment) is not the same as the impregnation with the solution in the present invention.

The Applicants explain that, according to its definition, the term "*impregnate*" has the following meaning (see, e.g., http://www.thefreedictionary.com):

a. To fill throughout; saturate;

b. To permeate or imbue;

impregnation - the process of totally saturating something with a substance;

saturation - the process of permeating or infusing something with a substance.

Therefore, what the present invention defines is the *impregnation* of the sheet material with the solution of a metal salt, which results in *permeating* the metal salt to the **inside** of the sheet material.

None of the two cited fragments discloses any kind of *impregnation* (i.e. *saturation* or *permeation*) of the solution into the workpiece or board 3.

Moreover, the Inoue patent as a whole does **not** disclose any kind of impregnation (i.e. saturation or permeation) of the solution into the workpiece or board 3.

Thus, one of distinctive features of the present invention over the Inoue patent is *the impregnation of the sheet material with the solution of the metal salt*. Just for this reason, Applicants believe that the Examiner's rejection of independent claim 1 has not been substantiated and should be withdrawn.

2. Also, the Examiner stated that the workpiece 3 is a silica board (see col.8 lines 9-10 of the Inoue patent):

"The workpiece 3 may, for example, be a silica board for formation of an electronic circuit thereon".

Apparently, the Examiner believes that a board made of silica (i.e. silicon dioxide or SiO_2) according to the Inoue patent is equivalent to the sheet material according to the present invention.

The Applicants respectfully disagree with the Examiner's opinion in this respect.

It is well known that silicon dioxide (SiO_2) relates to the group of glass-forming oxides and

usually represents colorless crystals of high hardness and strength. Further, silicon dioxide does not react with water and is soluble in hydrofluoric acid. The silicon dioxide most commonly occurs in the nature in a crystalline modification, i.e. quartz, and an amorphous modification of the silicon dioxide is quartz glass.

Thus, the material used by Inoue, i.e. a silica (silicon dioxide) board, is not physically capable of being impregnated with any solution, while the sheet material of the present invention is being impregnated with the solution of a metal salt. Thus Inoue clearly teaches away from the sheet material of the present invention.

Moreover, according to the present invention (see, e.g., the now amended claims 1 and 8), the creation of a metalized image on the sheet material will allow to reliably protect special products printed on the sheet material against counterfeit.

The term "*special products printed*" used in the present invention means those printed products or issues which need to be protected against counterfeit, such as valuable documents or security papers, for example bank notes, which are printed on a sheet of paper and must have protective features against counterfeit or falsification or inadmissible reproduction. The applicants consider it absolutely clear for a skilled person that the paper is implied here, because the printed products are predominantly produced on such paper sheet material.

Thus, another distinctive feature of the present invention over the Inoue patent is *the sheet material itself*, because a special printed product (e.g. paper) is used as the sheet material in the present invention, whereas a silica board is used as the sheet material in the Inoue patent.

Another distinctive feature of the present invention over the Inoue patent is the purpose of the image formation, because the present invention is aimed at providing features for protecting the sheet material against counterfeit, whereas the Inoue is aimed at formation of an electronic circuit on the sheet material (see col.8 lines 9-10).

In particular, the present invention aims at the protection against counterfeit of the products printed on the sheet material and to be protected by means of an original image which is created by the present invention inside the sheet material and which consists of a plurality of metalized points. It is clear that such image is difficult to falsify. It is also impossible to copy such image by a Xerox or the like.

3. Another distinctive feature of the present invention over the Inoue patent is the use of *laser radiation pulses*.

In the rejection of claim 7 of the present invention, the Examiner states:

"Inoue discloses the use [of] electromagnetic radiation in the form of carbon-dioxide laser (claim 18), argon gas laser (claim 17) with pulses of different duration (col.5, lines 46-49)."

This is not the case.

In fact, the cited claims 17 and 18 of the Inoue patent disclose "an argon gas laser beam" and "a carbon-dioxide gas laser beam", respectively. The cited column 5, lines 46-49 of the Inoue patent disclose as follows:

> "Accordingly, thanks to the invention, a metal deposit is achieved uniformly over such a substrate by controlling the time of irradiation or the rate of scan with the laser beam 11 or the local point thereof according to the position on the workpiece surface or substrate 3a. Generally, a recessed area or corner portion in a recess may be irradiated for a longer time than other areas."

Thus, this cited fragment discloses only *controlling the time of irradiation or the rate of scan with the laser beam 11*, contrary to *pulses of laser radiation* as in the present application.

Nowhere in the Inoue patent is mentioned that pulses of laser radiation are used.

Moreover, the Applicants point out that the controlling the time of irradiation or the rate of scan in the Inoue patent is not equivalent to the use of pulsed radiation in the present invention. The control of an irradiation time in Inoue's patent means making the irradiation time different (longer or shorter) at different areas of the workpiece surface but, in any case, the irradiation is performed using a *continuous* laser beam, rather than a pulsed laser beam as in the present invention.

Claims 2-4:

In the rejection of claim 2-4 of the present invention, the Examiner states:

"Inoue discloses a method that reads on the process of extraction of metal from the solution (col. 8, lines 23-25) by focusing electromagnetic radiation pulses provided by a laser (12) which are focused on a specified points by a laser beam (110 on the sheet material

surface (col. 5, lines 6-20).

In col. 8, Inoue discloses "depositing the desired material ...upon the pre-treated board", and in col. 5: "... the laser beam 11 acts as a narrow thermal beam to heat the depositing solution up to a temperature from 45° to 60° C..."

Here, the Applicants find it necessary to explain this difference between the laser beam in Inoue patent and the laser pulses of the present invention in more details.

In the Inoue patent, the heating is performed by a thermal beam (see col.5, line 7, claims 9, 14, 15), which can be either a beam of laser (see claims 16, 17 and 18), or a beam of xenon light (see claim 23). Meanwhile, it is stated in the Inoue patent that, when heating the solution of metal salt with a laser, the laser beam scans a workpiece 3 (see col.7 lines 8-10) by means of a mirror 111 (see col.6, lines 27-29 and Fig. 5) or a carriage 125 (see col.9 line 23 and Fig. 9). That is, what is discussed is the scanning of the workpiece with a continuous laser beam at a very low rate (speed) of the beam movement, being only 30 mm/min in deposition of nickel upon the workpiece from a sulfonic nickel chemical-depositing solution (col.7, lines 10-13). Therefore, the cited fragment in col.5 lines 46-49, is directed to controlling the time of irradiation, and not to regularly repeated pulses of laser radiation, which is not the same.

The fact that it does not matter for Inoue by what the solution above the silica board is heated (either by a laser beam or a beam of xenon light), makes it senseless to use a pulsed mode of laser operation. The pulsed mode of laser operation is characterized by a series of pulses repeated at equal intervals and allows generating the pulses of a high power. This is not needed in Inoue method, because Inoue heats the solution above the silica board only up to a maximal temperature of 80°C (see col.9, lines 9-11).

Also, as well known to persons skilled in the art, when an average output power of the laser is for example 0.5 watt (W), the output power of a single pulse at a pulse duration of 10 nanoseconds (ns) exceeds one thousand watts (see page 5, line 32-page 6, line 4 of the specification). By this short-time concentration of such enormous power within a small laser spot in the present invention, a very high temperature in the order of 3000°C arises in a small volume within the sheet material, causing the reduction of a metal salt to a metal and the deposition of the metal within the sheet material. Optionally, the metal deposition takes place in a recess (channel) formed in the sheet material by the laser beam (see Fig.1D of the present application). A combustion temperature of paper (preferable sheet material) is about

233°C. Therefore, the metal salt within the sheet material is subjected to very short (10 ns) pulses of laser radiation, thereby causing the metal salt to be reduced to the metal in each specified point and to be deposited in a recess (i.e. closed hole) formed by the laser beam in the body of the sheet material. Thereby, a protective image is formed in the present invention within the sheet material from a combination of such obtained metalized points. It is clear that such a metalized image provides for a reliable protection of the special products printed on the sheet material, because such image is difficult to falsify, is impossible to be copied by Xerox and the like. It is also clear that such image *within* the sheet material cannot be created by the method according to the Inoue patent.

Moreover, it is clear that, thanks to an interaction of the short laser pulses with the salts of several metals introduced inside the sheet material, the formation of metalized points from alloys of these metals is possible within the sheet material.

In the Inoue patent, it is not possible to create an image from metalized points inside the sheet material, as well as it is not possible to create therein an image from metalized points consisting of metal alloys, owing to the fact that the sheet material used by Inoue is impermeable for the solution containing the metal salt, and that the continuous laser radiation indirectly acts upon the sheet material, making its surface having the temperature not exceeding 80°C.

Claim 5:

In rejection of claim 5 of the present invention, the Examiner stated:

"Inoue discloses a method of forming channels or intricate contours (Fig.11, col.10, lines 22-23) in the workpiece or sheet material under the action of laser radiation".

In fact, the Examiner's cited fragment in col.10, lines 22-23 discloses literally as follows:

> "The arrangement of FIG. 11 is particularly advantageous for chemical-deposition of a workpiece with recessed surfaces or of an intricate contour as shown."

Applicants respectfully disagree for the following reasons:

Inoue initially uses a workpiece with previously recessed surfaces or an intricate contour, i.e. the workpiece 3 already has a recess or intricate contour in its surface 3a *before the irradiation with laser*. This is also clearly shown in Fig.11.

In other words, such a recess or intricate contour in the surface 3a of the workpiece 3 has been formed earlier with other means, but is not formed with a laser beam *in situ* during the deposition treatment. This fact is also confirmed by another fragment of the Inoue patent (see col.5, lines 51-53):

> "Generally, a recessed area or corner portion in a recess may be irradiated for a longer time than other areas."

Moreover, it is not principally admissible for Inoue to burn out any channels or recesses in the workpiece. This fact is confirmed by the Examiner itself in the end of rejection of claim 4, where the Examiner correctly stated that the duration of the laser radiation and size of the laser beam spot are controlled by Inoue "so that one can avoid the burn of the sheet material".

It should be also stressed here that the complete absence of any burning out the sheet material in the Inoue patent is not the same as the avoidance of burning through the sheet material according to the present invention. For example, as shown in Fig.1D of the present application and described on page 4, lines 22- 29 of the specification, the use of a different power (intensity) of the laser radiation pulses results in different consequences (see «at a small power of the radiation D1», «at a larger power of the radiation D2», «at a yet larger power of the radiation D3» and «in focusing the radiation D4 on a point located within the thickness of the sheet material»). These different consequences are described in the specification and also in the claims. According to claim 2, the laser radiation pulses are focused on the specified points of a surface of the sheet material, which results in producing the metalized specified points within the sheet material, but without formation of any recesses (channels). According to claim 5, the laser radiation pulses are not focused on the specified points and have a higher power, which results in producing the metalized points within the sheet material with formation of recesses (channels). Moreover, as appears from Fig.1D of the present application, by varying the power of laser radiation pulses, it is possible to provide for the formation of metalized points (i.e. pixels) of the image at different depths throughout the sheet material thickness. However, it is preferable to prevent the sheet material from burning through its whole thickness (i.e. from making a through hole) as recited in claim 4.

The above-mentioned principal inadmissibility of burning out any channels or recesses by the laser radiation in the specified points of the surface of the workpiece (silica board) according to the Inoue patent is caused by the fact that the surface of the workpiece at these

points should be coated (sensitized and activated) with a light-sensitizing substance and an activating agent consisting of a tin salt ($SnCl_2$) and a palladium salt ($PdCl_2$) to constitute nuclei for chemical deposition with a desired metal (see col.8, lines 15-22). Only thereafter, the thus pretreated silica board is placed into a bath with the solution containing a salt of desired metal, e.g. copper (see col.8, lines 23-25).

The laser radiation according to the Inoue concept is used only to heat the solution in the bath above the specified points of the pretreated silica board up to a temperature t = 45°C – 60°C in order to facilitate or accelerate the metal deposition from the solution onto the specified points of the board coated with the light-sensitizing substance or other agents. If any burning out of the sheet material by the laser radiation occurs in the Inoue patent, then said light-sensitizing substance or other agents would be removed from the board and therefore no metal deposition would take place thereon.

Therefore, in the apparatus according to the Inoue patent, the metals are deposited only at the coated or pretreated surface of the silica board, but not in channels formed by the laser radiation within the board, and any formation of such channels by the laser radiation in this apparatus is not contemplated or possible.

Claim 6:

In rejection of claim 6 of the present invention, the Examiner stated:
"Inoue discloses the process of preparing a solution in which several metal salts are present (col.8, lines 23-28), depositing simultaneously all the metals present in the solution at each of the specified point[s] of the workpiece [or] sheet material (col.8, lines 38-49) and forming metal alloys or doped metals (col.9, lines 3-14) at specified points (col.10, lines 22-23, Fig.11)."

This is <u>not</u> the case again.

The Examiner believes that in the Inoue patent, similar to the present invention, alloys can be formed from metals deposited from the solution at the specified points of the sheet material (silica board). In Examiner's opinion, for doing so, it is sufficient to heat up the solution to a temperature of 80°C, as indicated in 'Response to Arguments' section of the Office Action with reference to said col.9, lines 3-14.

First of all, it should be noted that Inoue does not teach the formation of alloys of metals at the specified points of the sheet material but, instead, Inoue teaches the chemical

deposition of different metals (copper, nickel) separately, see "In copper chemical deposition..." and "In nickel chemical deposition..." in col.9, line 3 and line 9, respectively. In particular, this is the copper chemical deposition for which Inoue suggests to decrease the temperature of the solution down to 3-10°C, and this is the nickel chemical deposition for which Inoue suggests to increase the temperature of the solution up to 80°C. In other words, different operating conditions are used in the Inoue patent for the deposition of different metals and, therefore, no simultaneous deposition of different metals can be performed therein.

Secondly, as commonly known, alloys are usually obtained by mixing components in molten state followed by cooling the mixture. Meanwhile, melting temperatures are 1083°C for copper and 1455°C for nickel. Since a temperature above 80°C is not achieved in the apparatus according to the Inoue patent, it is not possible at all to say about melting copper or nickel, as well as about obtaining alloys of these metals at the specified points of the silica board.

Summary

The present invention substantially differs from the Inoue patent in several aspects, namely:

(i) in the present invention, the metal salt(s) contained in the solution is/are introduced into the inside of the sheet material via **impregnating** the sheet material with the solution, whereas in the Inoue patent the laser radiation acts upon the metal salt-containing solution above the sheet material;

(ii) in the present invention, the sheet material itself is **permeable** for the solution, whereas in the Inoue patent the sheet material is **impermeable** for the solution;

(iii) in the present invention, the metal deposition occurs **within** the sheet material, whereas in the Inoue patent the metal deposition occurs **at the surface** of the sheet material;

(iv) in the present invention, the sheet material after said impregnation with the metal salt(s) thereinto is dried, and the interaction of the laser beam with the sheet material

occurs in open air, but **not in the bath with the solution** as in the Inoue patent. Moreover, in the Inoue patent, the solution in the bath should be constantly cooled down to 5°C or circulated above the sheet material at a moving speed of from 5 m/sec to 100 m/sec. Contrary, **no cooling or circulation** is needed in the present invention;

(v) in the present invention, the laser beam **directly** interacts with the sheet material. In the Inoue patent, the laser beam **indirectly** interacts with the sheet material, i.e. by way of heating the solution above the sheet material;

(vi) in the present invention, the surface of the sheet material needs **no treatment** before the introduction of the metal salts inside the sheet material by impregnation, whereas in Inoue patent, the surface of the sheet material is subjected to **a pre-treatment**, namely is etched in alkali and acid, followed by coating it with a light-sensitizing substance at those areas thereof onto which the desired metal will be subsequently deposited from the solution;

(vii) in the present invention, the impact of the laser radiation upon the sheet material having the metal salt present therewithin is provided by **pulses**, for example very short pulses having a duration of 10 ns, whereas in the Inoue patent the **continuous** laser radiation is used;

(viii) in the present invention, an image formation purpose is the **protection** of special products printed on the sheet material **against counterfeit**, whereas in the Inoue patent an image formation purpose is the **formation of an electronic circuit** on the sheet material.

In view of the above-mentioned amendments and arguments, it is absolutely clear that Inoue teaches away from the present invention as defined in the pending claims as originally filed and currently amended.

Accordingly, Applicants respectfully submit that the cited prior art does not teach the present invention as claimed in the pending claims, and claims 1-6 and 8 as recently amended are novel and patentable.

Therefore, the application is now in condition for allowance, which allowance is earnestly solicited.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application to Deposit Account No. 06-1135.

Respectfully submitted,

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